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RENEWAL OF "E" AWARD

Under date of February 3, Admiral C. C. Bloch, chairman of the Navy Board for Production Awards, notified the Bureau that, after careful consideration, a renewal of the Army-Navy "E" Award had been granted for an additional period of 6 months, dating from December 31, 1942.

This renewal gives the Bureau the right to add a second white star to its "E" pennant. Admiral Bloch congratulated the Bureau's employees on their achievement and added that "this award is difficult to win in the first instance and the requirements for renewal are equally exacting. By winning this additional honor you all have demonstrated a solid determination to supply our fighting forces with the materials they must have to bring this war to a successful conclusion."

DANGEROUS ANTIFREEZING SOLUTIONS

The danger of using antifreezing solutions containing calcium chloride and other salts in automobile cooling systems has long been recognized by the Bureau's automotive engineers, who have made a special study of this matter. They point out that the use of these solutions is prohibited in all Government-owned motor vehicles. An important step was taken recently by the War Production Board in its order forbidding the manufacture of antifreezes compounded with inorganic salts or petroleum distillates.

The present critical situation, which, if not controlled, might result in the actual destruction of thousands of automobiles, is an outgrowth of the shortage of ingredients used in the conventional antifreezing solutions. Many substitutes are being marketed, some of which, containing calcium chlorides and other salts, are advertised under brand names as permanent antifreezes.

Attempts to use these brine solutions have been made ever since automobiles were first driven in freezing weather, and serious results have always followed. The most expensive of these troubles has been hidden corrosion in the cooling systems. Water pumps and cylinder heads, particularly when the latter are of aluminum alloys, have developed leaks, which show up only after much damage already has been done. Under present conditions, parts thus damaged, particularly radiators made of copper, very probably can not be replaced.

Marketers of calcium chloride antifreeze compounds sometimes use inhibitors which they claim guard against corrosion. While it is always possible that some such inhibitor may be found, the Bureau does not know of any that is effective under the conditions of ac-

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tual use, even though some of them apparently are effective when tested in the laboratory at ordinary room temperatures.

Under present conditions, with no new cars to be had and with many replacement parts off the market, it approaches criminal negligence to take chances on the use of any of the antifreezing solutions containing inorganic salts, such as calcium chloride; certainly until some disinterested agency has shown beyond a doubt that this can be done with safety.

Any radiator preparation of undisclosed composition should be analyzed or avoided. If such a solution weighs between 10.5 and 11.5 pounds per gallon, it probably is based on calcium chloride. If the motorist already has a solution of unknown composition in his radiator, the following test is suggested:

> Put a few spoonfuls of the radiator solution in an iron skillet or dish (do not use aluminum) and heat on the stove, letting the solution boil down slowly. If there is a substantial deposit of salt left, the solution was a brine solution.

A simple chemical test which any layman can apply is this:

> Put a small quantity of the radiator solution in a water glass and add silver nitrate solution with a medicine dropper. The formation of a white deposit or precipitate (silver chloride) will indicate that the antifreeze was a brine solution. Empty the glass and rinse it with household ammonia before using it for any other purpose.

PROPOSED SUBSTITUTES FOR RUBBER

Since the beginning of the rubber shortage, many samples of proposed substitutes for rubber have been submitted to the Bureau for test. Although many different materials have been proposed, a great majority of them fail to meet certain simple tests that have been applied. It seems worth while, therefore, to describe tests to determine whether or not a proposed material possesses the basic characteristics of rubber to a sufficient degree to warrant further consideration and laboratory study.

Characteristic properties of rubber.—If a material is to serve as a practical substitute for rubber, it should be extensible, resilient, tough, waterproof, resistant to drying, and relatively unaffected by summer heat and winter cold. Simple tests which anyone can apply, to determine these properties are as follows:

1. Cut a strip of the material and note how much it can be stretched before it breaks. Observe also whether the broken portions snap back or whether they recover only slowly. If a material will snap back after being stretched to three or four times its original length, it has promise as a substitute for rubber; if it breaks before being stretched this much or if it recovers slowly, its probable usefulness will be correspondingly limited. If it cannot be stretched to at least double its original length, it can scarcely be considered for use in the place of rubber.

2. Try to cut the material with the thumbnail. If it resists cutting, it merits further consideration, but if it can be picked to pieces or if it crumbles when rolled vigorously between the thumb and forefinger, it could be considered only for minor uses, such as erasers.

3. Soak a thin piece of the material in water for a few days and note whether it disintegrates, swells, or becomes weaker than the original material. Although inability to withstand water need not bar a material from further consideration, it should be borne in mind that in most applications of rubber, waterproofness is an important consideration.

4. Keep a thin piece of the material in a warm, dry place for a week and note whether it retains its orginial extensibility and resilience. If it dries out or becomes hard and brittle, it can be of no use as a substitute for rubber.

5. Put some of the material in the freezing compartment of an electric refrigerator for a few hours and note whether it retains its extensibility or whether it becomes hard and brittle. Also put some of the material into boiling water and look for evidences of softening and melting. A material which does not withstand these extremes of temperature could replace rubber in a few applications, but would not be generally useful.

Factice and gels.—A majority of the proposed substitutes submitted to the Bureau represent two types of products which, though well-known to industry, apparently have been independently rediscovered by many inventors. These products are *factice*, prepared by the vulcanization of oils; and *gels*, made from glue or gelatine. A brief description of these materials will serve to indicate the respects in which they fail to meet the requirements outlined in the foregoing paragraphs as a general substitute for rubber.

The public seems to be almost entirely unfamiliar with factice, although it is an important industrial material and was known before rubber was introduced in Europe. The rubber-like properties of factice are such that it is often called "rubber substitute" by the trade. Commercial factice is of two main types. A brown or dark factice is prepared by heating vegetable or fish oils with sulfur. The vegetable oils may include rapeseed, linseed, corn, cottonseed, poppy seed, and castor oils. A white, or light, factice is prepared by the cold vulcanization of an oil with sulfur monochloride; rapeseed or corn oil is favored for the purpose. The principal application of factice is as a compounding ingredient, for which purpose it has been used for nearly 100 years. It is compatible with synthetic as well as with natural rubber and is employed in combination with them in making insulated wire, druggists' sundries, erasers, stationers' goods, and various other products. The use of factice alone is limited to minor products, such as Artgum erasers, because, in spite of many efforts, it has never been developed with properties which can meet the tests of extensibility and resilience, toughness, and resistance to temperature change shown to be necessary for a general rubber substitute.

Many persons are unaware of the fact that rubber-like compounds made from glue and gelatine have long been known and used in industry. They were extensively employed at one time in making printers' rolls, but were displaced to a large extent by synthetic rubber in the 1930's. With the present rubber shortage, however, they are coming back into use. The compounds from which printers' rolls are made usually contain glue or gelatine, water, glycerine, and a tanning agent. The glycerine keeps the compound from drying out, while the tanning agent stabilizes the compound and keeps it from softening with heat. At best, the gels made from glue and gelatine are so inferior to rubber in extensibility, toughness, and resistance to water that it is doubtful whether they will satisfactorily replace rubber in any but a few special products.

CONSERVATION OF LINSEED OIL IN PAINT

The conservation of linseed oil in paint is the subject of a Letter Circular (LC717) by E. F. Hickson, chief of the Bureau's section on paints, varnishes, and bituminous materials. This is intended as a contribution to the war effort, and the recommendations have the approval of the War Production Board, the Lead Industries Association, and the National Paint, Varnish & Lacquer Association. The principal methods of conserving linseed oil are discussed, with particular emphasis on less raw oil and more thinner when used with white-lead paste, etc., for exterior wood and with red lead, etc., for exterior metal. Tables of customary and proposed mixing formulas are given. The new system of two-coat exterior painting is described, as well as systems of interior painting, and the use of cold-water paints for interior and exterior use. Lists of Bureau Letter Circulars and of Federal Specifications for paints are included.

Copies of LC717 are obtainable without charge from the National Bureau of Standards, Washington, D. C.

PAINT FROM WASTE PRINTER'S INK

A plan to make paint out of waste ink scraped from the presses at the Bureau of Engraving and Printing has been under discussion by the general superintendent of the District of Columbia Penal Institutions and the Bureau of Engraving and Printing. Early in the year, samples of green- and black-ink pastes were received from the D. C. Penal Institution at Lorton, Va., with the request that the Bureau furnish information on what to mix with these pastes to make paint. After some experimental work, mixing formulas were developed and sent to the superintendent, who informed the Bureau that he is planning to turn out 70,000 gallons of paint a year.

MOISTUREPROOF MATCHES

Soldiers and sailors stationed in the tropics carry their strike-anywhere matches in small cannisters. When these are opened in the damp jungles or at sea, the matches absorb moisture and finally become worthless. To overcome this difficulty, the Bureau has experimented with matches that have been coated with moisture-resistant materials. Some of these were kept at a temperature of 100° F in an atmosphere of 95-percent relative humidity until none ignited when struck. Others were completely immersed in water and tested at intervals. One coating gave very promising results, in that matches treated with it were still usable after 5 days' exposure at 95-percent relative humidity or immersion in water for 4 hours. An order has been given to a manufacturer for an experimental lot of these matches.

MAINTENANCE OF ELEVATOR MECHANICAL SAFETY APPLIANCES

The second of the Bureau's publications on elevator maintenance is now available. This is Circular C442, Maintenance of Elevator Mechanical Safety Appliances, copies of which are obtainable from the Superintendent of Documents, Government Printing Office, at 5¢ each. The preceding paper, C441, dealt with wire-rope maintenance and was announced in Technical News Bulletin 309 (January 1943).

C442 is divided into four sections. The first is an introduction, and the second deals with the proper operation of governors and safeties. Governor items include clearances, driving-sheave wear, sluggish action, and condition of jaws and of governor rope. The functional requirements of the releasing carrier are discussed in detail. This is followed by a general paragraph on undercar safeties. The cleaning and maintenance of safeties are described, and the various commonly used types of safety equipment are discussed. These include instantaneous, flexible guide-clamp, wedge-clamp, and spring-actuated devices. The need for periodic tests is emphasized.

Requirements for guide rails, the need for adequate rail fastenings, effects produced when buildings settle, maintenance of rail surface, and inspection of rails after setting the safety are discussed in section III.

The fourth section, on buffers, covers the proper grade of oil for oil buffers, importance of maintaining the oil level, correct alinement of buffers, anchorage of buffer cases, corrosion of metallic parts, and flooding. The concluding paragraph is devoted to checking the alinement and supports of spring buffers.

The draft of the Circular was prepared by John A. Dickinson, chief of the Bureau's safety codes section, and was reviewed, modified, and approved by the Executive Committee for the American Standard Safety Code for Elevators, Dumbwaiters, and Escalators as its contribution toward elevator safety during the emergency. Adequate maintenance will do much to prolong the life of elevator machines, and slightly more than normal expenditures for upkeep at this time will pay handsome dividends because repair and replacement parts are at a premium and in some cases may be unobtainable.

SOIL-CORROSION CONFERENCE

A conference on soil-corrosion problems will be held in St. Louis, Mo., on March 25 and 26. As in the case of similar conferences in the past, the meeting will be open only to those who contribute papers. Each author is expected to supply 50 copies of his paper in advance, so that these can be distributed to the organizations that send representatives. Much interest has been shown in this conference; in particular, problems of cathodic protection are scheduled for special attention. Further information can be obtained from K. H. Logan, chief of the underground-corrosion section, National Bureau of Standards, Washington, D. C.

IMPACT RESISTANCE OF CONCRETE SHIPS

The current restrictions on the use of steel plate have again turned attention to the possibilities of constructing seagoing cargo ships and barges of reinforced concrete. One of the items of concern in the design and construction of concrete ships is the resistance of the hull to impact loads concentrated over a small area, such as might be encountered in minor collisions with floating debris, pier fenders, etc. The use of supplementary reinforcement in the form of a series of coils of large diameter wire, commonly known as spirals, has been suggested to increase the resistance of the reinforced concrete to impact loads. Therefore, a number of tests were conducted by Ralph W. Kluge on reinforced-concrete slabs of the design contemplated for use in the hulls of ships, and of several thicknesses, to determine the effect of supplementary spiral reinforcement on the impact resistance of the slabs. Results of the tests confirmed the value of the spiral reinforcement, showing that the slabs containing the spirals had a resistance to impact of from 1½ to almost 3 times that of similarly designed slabs without spirals. Also, the arrangement of the bar reinforcement in the slabs apparently influenced their resistance to impact.

AQUEOUS EXTRACTS OF CEMENT PASTES

When cement and water react, a solution is formed which contains various amounts of CaO, K_2O, Na_2O, Al_2O_3, and SO_3. In order to ascertain the properties of such solutions, George L. Kalousek, C. H. Jumper, and J. J. Tregoning have

determined the chemical composition, pH, conductivity, surface tension, and density of 7-minute and 2-hour extracts obtained from pastes of 12 portland cement clinkers. These clinkers were chosen to give a large range in alkali content because the effect of extractable potash and soda on the properties of cement products has been a much discussed subject for many years.

As explained in RP1530 in the March Journal of Research, the effects on the composition and physical properties of the extracts, produced by the addition of small amounts of various materials to the pastes, were studied in parallel experiments. The added materials included gypsum which was used in preparing the cements, calcium chloride, calcium acetate, fluosilicic acid, sucrose, T D A, tannic acid, and triethanolamine.

In the majority of the extracts, soda and potash were present in greater amounts than any of the other dissolved oxides. Relatively high concentrations of SO_3 occurred in the extracts of the clinkers that contained the larger amounts of K_2O. Triethanolamine increased the extraction of the alkalies from the clinkers much more than any other added material, and gypsum caused the greatest decreases. The extracts were saturated or supersaturated with respect to calcium hydroxide at 7 minutes, and the amounts in solution decreased as the alkali hydroxide concentration increased. The concentrations of silica and lime corresponded approximately to their solubility relations in the system lime-silica-water at 30° C. When organic materials were added to the pastes, the R_2O_3 content of the extracts was increased. The amounts of SO_3 in the extracts usually decreased in the interval between 7 minutes and 2 hours except in the filtrates from the cement pastes. These decreases, with accompanying increases in basicity, were deduced to be caused by the formation of calcium sulfoaluminate.

BLANKET-AND-SHEET COMBINATION FOR OUTDOOR USE

In an open lifeboat a combination of a blanket and sheet affords more protection against wind and rain or snow than a blanket alone. The combination of a blanket and a water- and wind-resistant cloth also has a number of advantages for army service, where blankets must meet all sorts of conditions. Although blankets and sheets are customarily used in homes, hospitals, and barracks, the possibilities of a sheet-blanket combination for outdoor use, where protection from wind and rain or snow, as well as from cold, is important, apparently has not received very serious consideration.

A study of the properties of blankets, recently completed by Herbert F. Schiefer, of the Bureau's textile section, included tests of combinations of blankets and sheets. The blankets selected for these tests varied greatly in air permeability, but in comparison, the permeability of the sheets was always low. The effect of moving air on the heat-retaining properties of the blankets and of the blanket between two sheets was evaluated. The results of this study will appear in RP1529 in the March Journal of Research. The effect of laundering on the weight, thickness, compressibility, compressional resilience, breaking strength, air permeability, and thermal transmission of the blankets is also reported.

PART-WOOL BLANKETS OR USE IN BARRACKS

Conservation of critical materials and the utilization of substitutes form an essential part of the war effort. The wool produced in the United States is not sufficient to meet military and civilian needs, and it has been necessary to import considerable quantities of the fiber annually. In a critical situation, such as exists at present, in which the supply routes might be cut, the wool on hand might not be adequate to meet essential military requirements. The Office of the Quartermaster General of the Army has recognized the urgency of this problem by appointing a Wool Conservation Committee to review Quartermaster Corps specifications for wool materials.

One possible conservation measure would be to replace the regular all-wool army blanket with a part-wool blanket for use in barracks and other indoor quarters of the armed services in noncombat zones of the interior. In order to have data upon which to base specifications for part-wool blankets, 33 blankets of 8 constructions, containing either 50 percent of wool and 50 percent of cotton, or 25 percent of wool and 75 percent of cotton, were subjected to analyses and tests. The results of these tests and of tests of the regular all-wool army blanket are given in a paper (RP1528) by Herbert F. Schiefer, Louis R. Mizell, and F. T. Mosedale in the Journal of Research for March. According to this report, part-wool

blankets should prove quite satisfactory in barracks, where their use would effect a substantial saving of wool, which might be needed for other military purposes.

ANALYSIS OF COMMERCIAL ENZYME PREPARATIONS

It is possible to extract substances (enzymes) from many products of biological origin such as seeds, animal organs, and microorganisms which catalyze certain reactions. Products of this sort are made in fairly large quantities for specialized purposes, such as the hydrolysis of starch, the clarification of fruit juices, the sizing and desizing of textile fibers, etc. In the belief that these enzyme mixtures or emulsins might be rich sources of other enzymes useful for manufacturing or analytical purposes, W. W. Pigman has analyzed 14 commercial or laboratory samples, representing the principal types available. In each case, their content of enzymes capable of hydrolyzing cane sugar (invertases) and polysaccharides of the inulin type (inulases) was determined. These latter polysaccharides are found in many plants, e.g., jerusalem artichokes, dahlias, chicory, etc., and, as shown by previous work at the Bureau, they seem to offer considerable promise for the large-scale production of the sugar levulose, as reported in the March Journal of Research (RP1526). Dr. Pigman has found that several commercial enzyme preparations made from the fungus, *Aspergillus niger* are fairly rich sources of the enzyme inulase which hydrolyzes these polysaccharides to levulose. It seems possible that the mild conditions of acidity and temperature, as well as the higher yields, may make the commercial application of enzymic hydrolysis feasible in spite of the present relatively high cost of the enzyme preparations.

In his original theory, Weidenhagen had postulated that inulase and invertase were identical, and that the enzymes with similar actions but from different sources were also identical. It is now shown that the *Aspergillus niger* emulsins contain much more of the inulin hydrolyzing enzymes (inulase) relative to the cane-sugar hydrolyzing enzyme (invertase) than the others, and hence that the two enzymes either are different or vary according to the source. The effects of acidity, temperature, and enzyme quantity on the enzyme catalyzed hydrolysis of inulin and cane sugar were also investigated. Methods for the expression of enzyme activity are discussed and certain recommendations made.

NEW AND REVISED PUBLICATIONS ISSUED DURING FEBRUARY 1943

Journal of Research [2]

Journal of Research of the National Bureau of Standards, volume 30, number 2, February 1943 (RP1519 to RP1525, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

Research Papers [2]

[Reprints from the December 1942 and January 1943 Journal of Research]

RP1508. Ten-year tests of high-early-strength cement concretes. Louis Schuman. Price 5 cents.

RP1509. Interval selector for random pulses. Francis J. Davis and Leon F. Curtiss. Price 5 cents.

RP1510. Combination of wool protein with acids in mixtures, and its relation to the acid dyeing of wool. Jacinto Steinhardt, Charles H. Fugitt, and Milton Harris. Price 5 cents.

RP1511. Analysis of the selective combination of wool with acids in mixtures. Jacinto Steinhardt. Price 5 cents.

RP1512. Further phase-equilibrium studies involving the potash compounds of portland cement. William C. Taylor. Price 10 cents.

RP1516. Nature of the reaction of wool with alkali. Louis R. Mizell and Milton Harris. Price 5 cents.

RP1517. Photochemical stability of papers. Herbert F. Launer and William K. Wilson. Price 5 cents.

Circulars [2]

C442. Maintenance of elevator mechanical safety appliances. Executive Committee for the American Standard Safety Code for Elevators, Dumbwaiters, and Escalators. Price 5 cents.

[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscriptions to Technical News Bulletin, 50 cents a year; Journal of Research, $3.50 a year (to addresses in the United States and its possessions and in countries extending the franking privilege); other countries, 70 cents and $4.50, respectively.

Simplified Practice Recommendations [2]

R41–42. Agricultural insecticide and fungicide packages. (Supersedes R41–40). Price 5 cents.

Technical News Bulletin [2]

Technical News Bulletin 310, February 1943. Price 5 cents. Annual subscription, 50 cents.

MIMEOGRAPHED MATERIAL

Letter Circulars

[Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having a definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.]

LC713. List of Commercial Standards—revised to January 1, 1943. (Supersedes LC705.)

LC716. Building regulation: Publications issued by the National Bureau of Standards. (Supersedes LC622.)

LC717. Conservation of linseed oil in paint. Eugene F. Hickson.

RECENT ARTICLES BY MEMBERS OF THE BUREAU'S STAFF PUBLISHED IN OUTSIDE JOURNALS [3]

Structure of the wool fiber as revealed by the microscope. Charles W. Hock. Scientific Monthly (Smithsonian Institution, Washington, D. C.) **55,** No. 6, 527 (December 1942).

Advances in plastics during 1942—general review. G. M. Kline. Modern Plastics (122 East 42d St., New York, N. Y.) **20,** No. 5, 85 (January 1943).

Torsional-elastic properties of 18–8 Cr–Ni steel. R. W. Mebs and D. J. McAdam, Jr. Technical Note No. 886 (Natl. Advisory Com. for Aeronautics, 1500 N. H. Ave., N. W., Washington, D. C.) (January 1943) (Restricted distribution).

Proceedings of the Philosophical Society of Washington, October 1941 to May 1942. Fred L. Mohler, recording secretary. J. Wash. Acad. Sciences (Raymond Seeger, George Washington University, Washington, D. C.) **32,** 311 (October 15, 1942).

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[2] See footnote on p. 22.

[3] These publications are not obtainable from the Government, unless otherwise stated. Requests should be sent direct to the publishers.

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